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The Impact of Public Transportation Use on Cognitive Function in Older Age: A Quasi-Experimental Evaluation of the Free Bus Pass Policy in the UK

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Running head: Public Transport and Cognitive Health in Older Age

ABSTRACT

This quasi-experimental study examines whether the introduction of an age-friendly transportation policy, free bus passes for older adults, increased public transport use and in turn impacted cognitive function among older people in England. Data comes from 7 waves (2002-2014) of the English Longitudinal Study of Ageing (n =17,953), which measures global cognitive function, memory, executive function, and processing speed before and after the bus pass was introduced in 2006. The analytical strategy is an instrumental variable approach with fixed effects, which exploits the age-eligibility criteria for free bus passes and addresses bias due to reverse causality, measurement error, and time-invariant confounding. Eligibility for the bus pass is associated with a 7% increase in public transport use. The increase in public transportation use is associated with a 0.346 (95% confidence interval (CI): 0.017,0.674) increase in the global cognitive function Z score and with a 0.546 (95% CI: 0.111,0.982) increase in memory Z score. Free bus passes increase public transport use, which in turn benefits cognitive function in older age. Public transport use may promote cognitive health through encouraging intellectually, socially, and physically active lifestyles. Transport policies may serve as public health tools to promote cognitive health in ageing populations.

Key Words: Aging, Cognition, Cognitive Aging, Transportation, Policy

Abbreviations: CI, confidence interval; ELSA, English Longitudinal Study of Ageing; FE, fixed effects; IV-FE, instrumental variable with fixed effects

Ageing is associated with declines in cognitive function, particularly fluid intelligence, which includes memory, executive function, and processing speed (1). However, there is considerable variation in levels of cognitive function and rates of cognitive decline partly as a result of exposures over the life course (1). Maintaining cognitive health is critical for autonomy and well-being, as cognitive impairment is a key predictor of disability and death in older age (1). With around one fifth of the UK population currently 65 and older (2), and similar trends projected in the US by 2030 (3) and worldwide by 2050 (4), rapid population ageing makes the promotion of cognitive health an urgent target for public health policy.

Evidence suggests that physically, socially, and intellectually active lifestyles protect against cognitive decline (1). The ability of ageing individuals to maintain an active lifestyle may depend on the levels of mobility enabled by the built environment (4, 5). In particular, public transportation plays an increasingly important role in promoting mobility, physical activity, social engagement, leisure activities, and physical and mental health among older people (6-11). While these benefits may also extend to cognitive health, there is limited evidence on how policies that encourage public transportation use impact cognitive function in older people.

Research suggests making public transportation more affordable increases transport use and engagement among older people (6, 7, 9). In the UK, the older person's free bus pass, introduced in 2006, allows older adults to travel for free on public buses throughout the country (12). This scheme provides a natural experiment to examine how a policy that encourages older people to use public transportation impacts cognitive function. Previous evaluations show the policy led to increases in public transport use among older people, as well as higher levels of physical activity and social engagement and lower levels of obesity, depressive symptoms, and loneliness (6-8). There is reason to expect that by encouraging social, intellectual, and physical activity, increased public transport use due to the free bus pass may also benefit cognitive health among older people. For example, social interaction and intellectually-stimulating activities require use of cognitive faculties, which according to the 'use it or lose it' hypothesis, has direct impacts on brain structure and function that protect against cognitive decline (1, 13, 14). Additionally, physical activity bolsters cognitive health through cardiovascular, cerebrovascular, and neurotrophic pathways (15).

In this study, we examine the impact of increased public transportation use on measures of cognitive function among older people in England. As older people with higher cognitive function may be more likely to use public transport from the outset, this study exploits the introduction of the free bus pass policy, longitudinal data, and a quasi-experimental design to address reverse causality and time-invariant confounding.

METHODS

Data and measures

We use longitudinal data from waves 1 to 7 of the English Longitudinal Study of Ageing (ELSA), a representative cohort of individuals aged 50 and older residing in England (N =18,489), which has been described elsewhere (16). We exclude individuals who are younger than 50 (N = 498), who reside outside of England (N = 1), and whose actual age-based eligibility for the bus pass cannot be determined due to increases in the eligibility age (N = 35). Previous work indicates that including these individuals under various assumptions about their bus pass eligibility does not impact results (6). This provides an eligible sample of 17,953 individuals. The study period includes years before (wave 1 and 2, collected in 2002 and 2004) and after (waves 3 to 7, collected every two years between 2006 and 2014) the introduction of the free bus pass.

Cognitive function

The outcomes include memory, executive function, processing speed, and global cognitive function, based on tests conducted during ELSA interviews at multiple waves (17). We use scores from the word recall test, the animal naming test, and the letter cancellation test, as these tests were found to be robust to floor, ceiling, and practice effects in previous studies using ELSA (18, 19).

Memory is measured using the word recall test, conducted at every wave. The respondent is asked to remember 10 common nouns, which are presented to them aurally using a taped voice. The respondent is asked to recall the words immediately and after a short delay during which they complete other cognitive tests. The total word recall score, ranging from 0 to 20, is the sum of the words correctly remembered during the immediate and delayed recall. Executive function is measured using the animal names test, conducted in waves 1 to 5, and wave 7. The respondent is asked to name as many different animals as possible in one minute. The score is the total number of animals named, which ranged from 0 to 50 at baseline. Processing speed is measured using the letter cancellation test, conducted in waves 1 to 5. The respondent is given a piece of paper with random letters and asked to cross out as many of the 65 target letters (P's and W's) as possible in one minute by working across and down the page. The score is the total number of letters searched, ranging from 0 to 65.

The total scores from the three tests are transformed into Z-scores, standardized across all waves, and then averaged for a total cognitive function score, as has been done in previous studies (20). The total cognitive function score is available for waves 1 to 5. For every measure, a higher score indicates better function.

Public transportation use

In the first two waves, participants are asked: "Do you use public transport… a lot, quite often, sometimes, rarely, or never." In the third wave, the question changes to: "How often do you use public transport… every day or nearly every day, 2 or 3 times a week, once a week, 2 or 3 times a month, once a month or less, or never." As never is the only consistent response category, we create a binary variable that assigns 1 to public transport users and 0 to non/never users at each wave. Previous studies show that this measure is robust to the change in questionnaire and different classifications of transport use frequency (6-8).

Control variables

We control for the following time-varying characteristics: age, age squared, at least one limitation in the activities of daily living, at least one limitation in the instrumental activities of daily living, car ownership, any chronic illnesses/disabilities/diseases, the natural log of net total non-pension household wealth, the natural log of equivalised household income, marital status (married, cohabitating, single/never married, widowed, divorced, separated), and household region.

The instrument: free bus pass eligibility

We exploit eligibility for free bus passes as an exogenous source of variation in public transportation use. We use a binary variable to indicate whether individuals are eligible for free bus travel at each wave, based on government criteria for eligibility age. Specifically, those who are at least 60 years old between April 2006 and March 2010 are classified as eligible. In April 2010, the bus pass eligibility age began increasing in monthly increments corresponding to increases in women's state pension age (12). As birth month is not publicly available in ELSA, we round up the eligibility age to 61 between April 2012 and 2012, to 62 between 2012 and 2013, and to 63 in 2014. The interaction between the eligibility age and the timing of the bus pass legislation is the basis for causal identification, as eligibility varies both due to age and year of measurement in the study.

Statistical analysis

We first implement linear fixed effects (FE) models without the instrument, as Hausman specification tests (21) reject the null hypothesis that random effects models are consistent (Web Table 1). The FE model estimates whether a change in public transport use is associated with a change in cognitive function, controlling for measured time-varying confounders. FE models essentially rule out confounding by time-invariant characteristics, such as early-life intelligence and education, by treating each individual as their own control (22).

As the FE estimates may be biased due to reverse causality (i.e. cognitive function determines transport use), omitted variables (i.e. unmeasured confounders), and measurement error, we implement a 2 stage least squares instrumental variable approach with fixed effects (IV-FE) as the main model (23, 24). The IV-FE model enhances causal inference by using fixed effects to control for time-invariant confounding and by using the instrument to address reverse causality and unmeasured or erroneously measured confounders (24).

Three assumptions must be met to yield unbiased estimates of the relationship between transport use and cognitive function using the instrument. First the instrument (free bus pass eligibility) must be predictive of the endogenous treatment variable (public transport use). We establish whether eligibility is strongly associated with public transport use with the first stage F-statistic (25).

The related second and third assumptions are that the instrument must only impact the outcome (cognitive function) through its impact on the endogenous treatment variable (transport use), and the instrument must not be associated with unmeasured confounders. Other variables, such as depressive symptoms, may lie on the pathway between public transport use and cognitive function. However, if the impact of bus pass eligibility on these other variables is also through the impact on transport use, this would not invalidate the second assumption. Another potential concern is that bus pass eligibility age overlaps with women's state pension age. To address this, we control for employment status, state and private pension receipt in our models and implement sensitivity analyses, detailed below.

In the first stage of the IV-FE model, public transportation use is regressed on bus pass eligibility and all control variables. In the second stage, the cognitive function score is regressed on the predicted values of public transportation use from the first stage and all control variables. Using IV-FE, we can assess whether becoming eligible for the bus pass leads to changes in public transport use in the first stage and whether this increase in transport use leads to changes in the level of cognitive function in the second stage. A directed acyclic graph (Web Figure 1) and the equations for the FE model and the two stages of the IV-FE model are provided in the Web Appendix. The models are run using the command xtivreg2 (26), a wrapper for ivreg2 (27), in Stata, version 15 (28).

Sensitivity and subgroup analyses

Testing the IV-FE results, we implement a sensitivity analysis excluding controls for activities of daily living, instrumental activities of daily living, and chronic health conditions, as these may be mediators of the impact of public transport use on cognitive function or partially capture the outcome. As those with missing scores for the cognitive function tests may be systematically different, we conduct a sensitivity analysis using multiple imputation with chained equations. Missing values are detailed in Web Table 2. Additionally, we test whether using a balanced panel affects results, by limiting the sample to individuals who participated in every wave with complete cognitive function measures. As education is a key predictor of later life cognitive function (1), we run subgroup analyses by educational level (low, medium, high).

We also implement several models to address potential bias from the overlap between women's state pension age and bus pass eligibility age. First, the two waves of ELSA data before the bus pass was introduced serve as a placebo, during which women turning 60 would become eligible for state pensions but not for bus passes. We run an IV-FE model on the first two waves of data using age 60 as 'placebo' instrument for public transport use. Additionally, men's state pension age is higher than the bus pass eligibility age throughout the study period, which enables us to isolate the impact of bus pass eligibility age from that of pension eligibility age. We therefore present subgroup analyses by gender.

RESULTS

Table 1 suggests that users and non-users of public transportation differ along all covariates at baseline, based on chi square tests. Public transport users are more likely to be female, retired, and live in London, and less likely to have a car, any chronic health conditions or limitations in activities or instrumental activities of daily living than non- users. Additionally, the ratio of transport users to non-users increases around the bus pass eligibility age (Web Figure 2).

Figure 1 shows locally weighted regression smoothed curves of (A) total cognitive function (B) memory (C) executive function and (D) processing speed scores. For all domains of cognitive function, average scores decline among both transport users and non-users as age increases. However, the average score for transport users is higher than the score for non-transport users at all ages. While this may suggest that public transport use is associated with better cognitive function, it may also reflect confounding or reverse causality. In order to address this, we move to the results of the regression models.

Web Table 3 presents the results from the first stage of the IV-FE model. The first stage of the IV-FE model indicates that becoming eligible for the free bus pass leads to a 7% increase in the probability of public transport use. The F-statistic is greater than 10, meeting the criteria for a strong first stage (25), and additional tests for weak identification and underidentification indicate the first stage is strongly identified in all models (Web Table 4).

Table 2 presents the results from models that estimate the association between public transport use and cognitive function. In the FE models without the instrument (Model 1, Table 3), becoming a public transport user is associated with a 0.014 (95% CI: 0.000,0.028) increase in total cognitive function Z score, a 0.028 (95% CI: 0.010,0.046) increase in memory Z score, and a 0.031 (95% CI: 0.011,0.051) increase in executive function Z score. In the second stage of the IV-FE models (Model 2, Table 2), increased public transport use due to the free bus pass is associated with a 0.346 (95% CI: 0.017,0.674) increase in total cognitive function Z score and a 0.546 (95% CI: 0.111,0.982) increase in memory Z score.

Sensitivity analyses

Results are robust to different sensitivity analyses, presented in Figure 2 for (A) total cognitive function (B) memory (C) executive function and (D) processing speed scores (full estimates in Web Table 5). Results are consistent when excluding variables which may be mediators or partially capture cognitive function (activities of daily living, instrumental activities of daily living, and chronic illness), using a balanced panel, and using multiple imputation for missing values. Analyses stratified by gender indicate that estimates for total cognitive function and memory scores are larger and more consistent for men than for women, suggesting our main results are unlikely to reflect confounding by state pension eligibility. Results are also in the same direction as the main models for the low, medium, and high education groups. However, results for total cognitive function score are weaker for the low education group, while results for memory score are stronger for the high education group.

Results are also consistent when excluding individuals above the age of 90 and restricting the sample to individuals between the ages of 50 and 70 (Web Table 6). Web Table 7 presents the IV-FE model that uses age 60 as a 'placebo' instrument before the introduction of the bus pass; the results suggest there is no impact of reaching women's state pension age on public transport use or cognitive function before the bus pass policy.

DISCUSSION

Our findings suggest that increased public transport use due to the free bus pass is associated with improved cognitive function, particularly memory scores. To our knowledge, this is the first study to show that public transportation use may benefit cognitive function among older adults. The results of this study expand on earlier literature documenting the benefits of the free bus pass for physical activity, obesity (7, 8), social engagement, mental health (6), and quality of life and well-being (9, 10).

Public transport use may promote the maintenance and enhancement of cognitive function among older people by increasing participation in physical, social, and intellectually stimulating activities. First, previous studies have linked the free bus pass and public transportation use to higher levels of physical activity (7, 8). Physical activity protects cognitive health by reducing cardiovascular and cerebrovascular risks and by upregulating molecules involved in healthy brain structure and function (15). Second, research has also linked increased public transportation use due to the free bus pass with social engagement, such as volunteering and spending time with children and friends, and with reductions in depressive symptoms and loneliness (6). Studies have also documented how the bus ride itself can be a social activity, by offering opportunities for social interaction and group travel (9). Social engagement is postulated to benefit cognitive health by increasing use of cognitive faculties in social interactions, reducing stress, and promoting mental and physical health (13, 29). Third, the free bus pass may have increased participation in intellectually-stimulating activities, for example in cultural, educational, or civic settings, which may benefit cognitive health through the 'use it or lose it' hypothesis (1). We explored this question with available ELSA data and found that increased public transportation use due to the free bus pass is indeed linked to increased likelihood of at least monthly participation in cultural activities (theatre, museums, galleries, cinema), although it is not associated with civic or social group membership (Web Table 8). Finally, it is important to consider the positive utility or intrinsic value of transport use for cognitive function (30). The bus ride itself may serve as a cognitively-stimulating environment or activity that directly benefits cognitive health (31).

The strengths of this study include the use of a quasi-experimental design and IV-FE model, which addresses reverse causality, time-invariant confounders, and unmeasured or poorly measured confounders. As later life cognitive function is strongly determined by early life cognitive capacity and education level, and these factors may also be associated with transport use, the instrument allowed us to isolate the impact of public transport use on cognitive function.

There are several limitations to this study. First, the measurement of cognitive function is based on a range of standardized tests, which may be subject to measurement error. However, previous studies using ELSA have found that the specific measures used in this study are robust to practice, ceiling, and floor effects (18, 19). There were concerns about the overlap between women's state pension age and bus pass eligibility age; however, the results of the placebo IV-FE model in the period before the free bus pass policy suggest that this overlap is unlikely to explain our main results. Additionally, we found that the impact of increased public transport use due to the free bus pass was stronger for men, whose state pension eligibility age is different from the bus pass eligibility age. If anything, the overlap between women's state pension age and bus pass eligibility age may have led to an underestimation of the impact on women, as cognitive function tends to decline after retirement (32). Geographic variation in public transportation systems may also impact results. As London likely has the most extensive transport system, we implemented sensitivity analyses excluding London (Web Table 9). Results are similar to the main results, suggesting the main estimates are not specific to London's more robust transport system. Additionally, in 2012, London introduced free travel on public transportation for residents age 60 and older (33). Defining eligibility for London residents based on this expanded scheme yielded similar estimates to the main model (Web Table 10). We note that the second stage estimates for the IV-FE models are larger than the estimates for FE models that do not use the instrument. This may reflect the fact that the IV-FE model is estimating the local average treatment effect among the 'compliers' – those who are induced to become public transport users due to becoming eligible for the free bus pass, while the FE model is estimating the average association between public transport use and cognitive function in the total sample (23). Understanding the impact of public transport use among the 'compliers' is of interest from a public health and policy perspective, because it reflects the impact of the bus pass among those who change their behavior in response to the policy. It is likely that this group increases with age. For example, ageing is associated with driving cessation, which may increase reliance on public transportation (34). In addition, as income declines after retirement, free bus passes become an increasingly important economic incentive to begin or increase public transport use (35).

In conclusion, this study provides evidence that a national, age-friendly public transportation policy that enables free bus travel can improve cognitive function among older people. These benefits are likely due to the role of public transportation in promoting physical activity, social engagement, and participation in intellectually-stimulating activities, all of which predict better cognitive function (1). Free bus passes only address the affordability dimension of public transportation, and other policies that improve the availability and accessibility of public transportation may also be necessary to fully realize the cognitive health benefits of public transportation use for older people. The findings of this study suggest that public transportation policies may serve as public health tools to promote active lifestyles and cognitive health among older people.

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TABLES

Table 1: Characteristics of public transport users and non-users at baseline, English Longitudinal Study of Ageing, 2002-2014

Baseline Characteristics	Users (n =12,217)[a]		Non-Users (n = 5,471)[a]		χ^2 P-value	Total (n = 17,688)[b]	
	No.	%	No.	%		No.	%
Age					<0.001		
<60	6042	49.5	2806	51.3		8848	50.0
60-74	4602	37.7	1797	32.8		6399	36.2
75+	1573	12.9	868	15.9		2441	13.8
Gender					<0.001		
Male	5181	42.4	2943	53.8		8124	45.9
Female	7036	57.6	2528	46.2		9564	54.1
ADL's[c]					<0.001		
None	10432	85.4	4116	75.2		14548	82.3
At least 1	1782	14.6	1355	24.8		3137	17.7
IADL's[c]					<0.001		
None	10385	85.0	4041	73.9		14426	81.6
At least 1	1829	15.0	1430	26.1		3259	18.4

Illness[c]					<0.001		
No Illness	5922	48.5	2317	42.4		8239	46.6
Any Illness	6291	51.5	3153	57.6		9444	53.4
Access to Car[c]					<0.001		
Yes car	9975	81.7	5027	91.9		15002	84.8
No car	2240	18.3	442	8.1		2682	15.2
Employment Status					<0.001		
Employed	5262	43.1	2425	44.3		7687	43.5
Unemployed	179	1.5	72	1.3		251	1.4
Retired	4998	40.9	1959	35.8		6957	39.3
Out of Labour Force	1778	14.6	1015	18.6		2793	15.8
Marital Status[d]					<0.001		
Married/Civil Partnership	8104	66.3	3914	71.5		12018	67.9
Cohabitating	671	5.5	321	5.9		992	5.6
Single, never married	697	5.7	227	4.1		924	5.2
Widowed	1524	12.5	605	11.1		2129	12.0
Divorced	992	8.1	325	5.9		1317	7.4
Separated	229	1.9	79	1.4		308	1.7
Region[c,d]					<0.001		
North East	809	6.6	331	6.1		1140	6.4
North West	1587	13.0	744	13.6		2331	13.2
Yorkshire and the Humber	1289	10.6	599	11.0		1888	10.7
East Midlands	1095	9.0	649	11.9		1744	9.9
West Midlands	1230	10.1	711	13.0		1941	11.0
East of England	1421	11.6	661	12.1		2082	11.8
London	1468	12.0	209	3.8		1677	9.5
South East	2082	17.1	840	15.4		2922	16.5
South West	1229	10.1	726	13.3		1955	11.1
Non-Pension Wealth[e]	271385 (619467)		238277 (565842)			260134 (599970)	
Equivalised Income[e]	306 (251)		287 (256)			301 (270)	
Private Pension					<0.001		
Receives Private Pension	8318	68.1	3894	71.2		12212	69.0
No Private Pension	3899	31.9	1577	28.8		5476	31.0
State Pension[c]					<0.001		
Receives State Pension	6971	57.5	3343	61.6		10314	58.8
No State Pension	5152	42.5	2088	38.4		7240	41.2

Abbreviations: ADL's, activities of daily living; IADL's, instrumental activities of daily living

[a]Values are numbers (column %) unless otherwise indicated

[b]Difference in table total and total eligible sample is due to 265 participants with missing data on transport use at baseline

[c]Numbers do not sum to total due to missing data on baseline characteristics

[d]Percentages do not sum to 100 due to rounding
[e]Values are expressed as mean (standard deviation)

Table 2: The impact of public transport use on cognitive function: Results of the FE and the IV-FE 2nd Stage Models, English Longitudinal Study of Ageing, 2002-2014

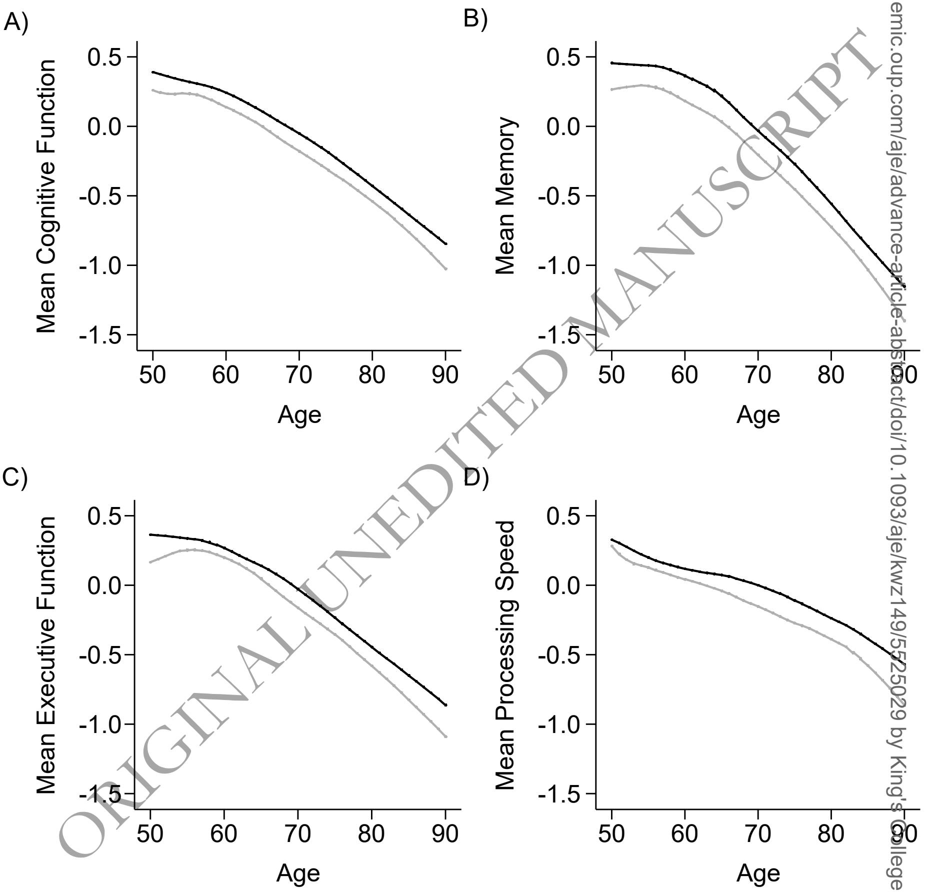
Outcome	Model 1: FE[a]			Model 2: IV-FE 2nd Stage[b]		
	β	95% CI	P[c]	β	95% CI	P[c]
Total Cognitive Function	0.014	0.000,0.028	0.047	0.346	0.017,0.674	0.039
Memory	0.028	0.010,0.046	0.002	0.546	0.111,0.982	0.014
Executive Function	0.031	0.011,0.051	0.002	0.323	-0.153,0.800	0.184
Processing Speed	0.001	-0.023,0.025	0.941	0.332	-0.234,0.898	0.250

Abbreviations: β, β coefficient; CI, confidence interval
[a]Model 1: controls for age, age squared, wave, any limitations in the activities of daily living, any limitations in the instrumental activities of daily living, any chronic illnesses, car ownership, log net total household wealth, log equivalized household income, employment status, marital status, region, private pension receipt, and state pension receipt
[b]Model 2: controls for age, age squared, wave, any limitations in the activities of daily living, any limitations in the instrumental activities of daily living, any chronic illnesses, car ownership, log net total household wealth, log equivalized household income, employment status, marital status, region, private pension receipt, and state pension receipt
[c]2 sided P-values

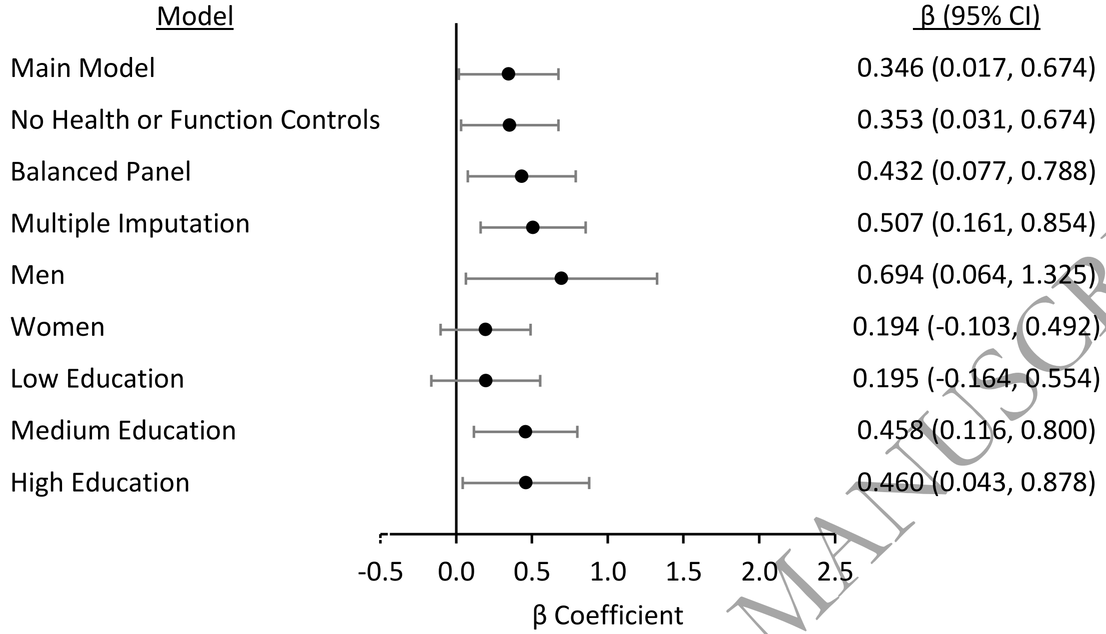
FIGURES

Figure 1: Locally weighted regression, mean A) total cognitive function, B) memory, C) executive function, and D) processing speed Z scores by age for public transport users and non-users, English Longitudinal Study of Ageing, 2002-2014. Public transport users shown in black, non-users shown in grey. Y axis represents mean Z score for A) total cognitive function B) memory C) executive function and D) processing speed.

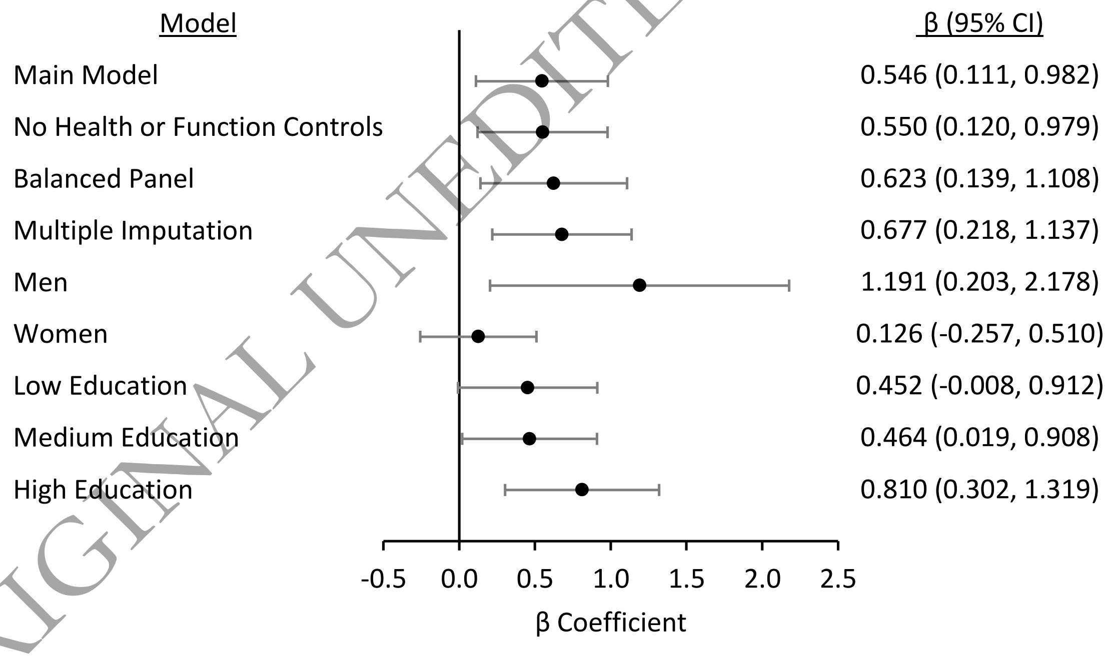
Figure 2: β coefficients and 95% confidence intervals from main models, sensitivity analyses, and subgroup analyses for A) total cognitive function B) memory C) executive function and D) processing speed, English Longitudinal Study of Ageing, 2002-2014. Abbreviations: β, β coefficient; CI, confidence interval.


A)
Mean Cognitive Function
Age
B)
Mean Memory
Age
C)
Mean Executive Function
Age
D)
Mean Processing Speed
Age
0.5
0.0
-0.5
-1.0
-1.5
50
60
70
80
90

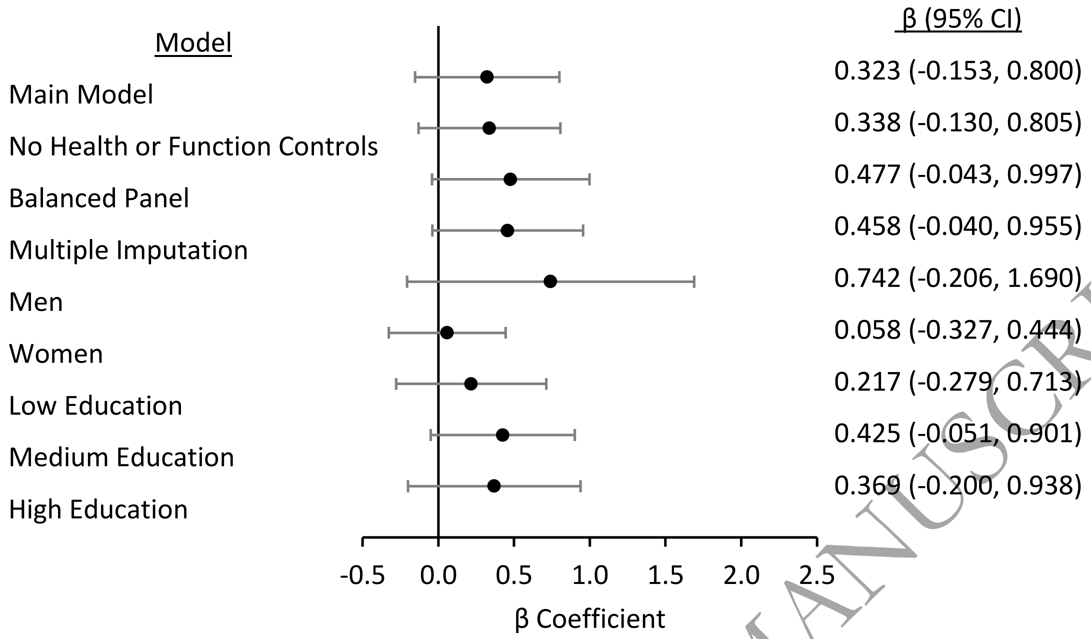
A)


Model
β (95% CI)
Main Model
0.346 (0.017, 0.674)
No Health or Function Controls
0.353 (0.031, 0.674)
Balanced Panel
0.432 (0.077, 0.788)
Multiple Imputation
0.507 (0.161, 0.854)
Men
0.694 (0.064, 1.325)
Women
0.194 (-0.103, 0.492)
Low Education
0.195 (-0.164, 0.554)
Medium Education
0.458 (0.116, 0.800)
High Education
0.460 (0.043, 0.878)
-0.5 0.0 0.5 1.0 1.5 2.0 2.5
β Coefficient

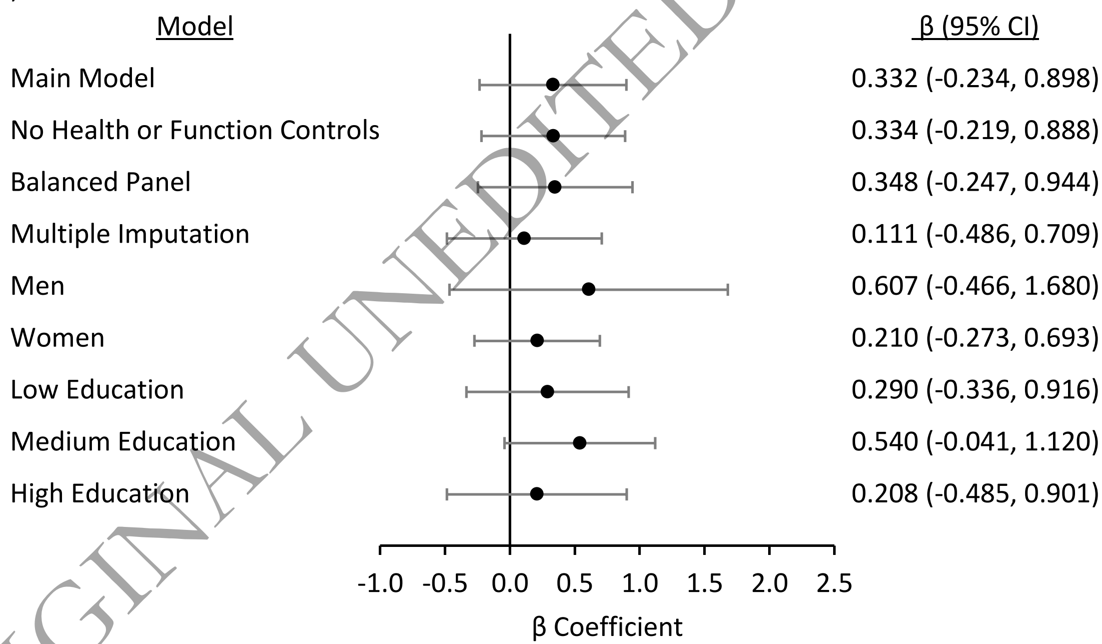
B)


Model
β (95% CI)
Main Model
0.546 (0.111, 0.982)
No Health or Function Controls
0.550 (0.120, 0.979)
Balanced Panel
0.623 (0.139, 1.108)
Multiple Imputation
0.677 (0.218, 1.137)
Men
1.191 (0.203, 2.178)
Women
0.126 (-0.257, 0.510)
Low Education
0.452 (-0.008, 0.912)
Medium Education
0.464 (0.019, 0.908)
High Education
0.810 (0.302, 1.319)
-0.5 0.0 0.5 1.0 1.5 2.0 2.5
β Coefficient

C)


Model
Main Model
No Health or Function Controls
Balanced Panel
Multiple Imputation
Men
Women
Low Education
Medium Education
High Education
β (95% CI)
0.323 (-0.153, 0.800)
0.338 (-0.130, 0.805)
0.477 (-0.043, 0.997)
0.458 (-0.040, 0.955)
0.742 (-0.206, 1.690)
0.058 (-0.327, 0.444)
0.217 (-0.279, 0.713)
0.425 (-0.051, 0.901)
0.369 (-0.200, 0.938)
-0.5 0.0 0.5 1.0 1.5 2.0 2.5
β Coefficient

D)


Model
Main Model
No Health or Function Controls
Balanced Panel
Multiple Imputation
Men
Women
Low Education
Medium Education
High Education
β (95% CI)
0.332 (-0.234, 0.898)
0.334 (-0.219, 0.888)
0.348 (-0.247, 0.944)
0.111 (-0.486, 0.709)
0.607 (-0.466, 1.680)
0.210 (-0.273, 0.693)
0.290 (-0.336, 0.916)
0.540 (-0.041, 1.120)
0.208 (-0.485, 0.901)
-1.0 -0.5 0.0 0.5 1.0 1.5 2.0 2.5
β Coefficient